For all the tea in Kenya

Impact assessment and baseline situation of Farmer Field Schools

LEI
WAGENINGEN UR

In partnership with

This study was commissioned by KTDA, Unilever and IDH-the sustainable Trade initiative.

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Acronyms

ATT	Average treatment effect on the treated
DiD	Difference in differences
FFS	Farmer Field School
FSCs	Field Services Coordinators
GAPs	Good Agricultural Practices
IDH	The Sustainable Trade Initiative
KES	Kenya Shilling
KTDA	Kenya Tea Development Agency
NGOs	Non-Governmental Organisations
PPE	Personal Protection Equipment
PSM	Propensity score matching
RA	Rainforest Alliance
SAN	Sustainable Agriculture Network
TESA	Tea extension Services Assistant

Preface and acknowledgements

Farmer Field Schools (FFS) are a popular education and extension approach worldwide. Co-funded by the UK Government's Department for International Development (DFID), the Kenya Tea Development Agency (KTDA) and Lipton Sustainable Agriculture Project introduced pilot FFS in four KTDA managed factories in 2006. The purpose was to improve sustainability of tea production by enhancing the adoption of Good Agricultural Practices (GAPs) in tea as well as improving tea profitability and livelihoods of smallholder growers.

Based on the good results from the pilot phase in 2006, the partnership of KTDA, Unilever and IDH started their Sustainable Tea Program in 2009 with the aim to reach all 65 processing factories of the 54 KTDA tea factory companies. The up-scaling of FFS in this phase was mainly led by Tea Extension Service Assistants (TESAs), of which LEI Wageningen UR conducted an impact study in 2012.

In order to reach more farmers and buying centres of every KTDA processing plant, KTDA, Unilever and IDH have launched their Sustainable Tea Program in 2013 for a new up-scaling phase with selected FFS graduate farmers helping in initiating and running FFS activities (farmer-led FFS). They do this under the guidance of TESAs and FFS facilitators.

Now that the FFS programme is being up-scaled throughout and embedded within the entire KTDA factory and management system, KTDA, Unilever and IDH want to evaluate their Sustainable Tea Program. They have commissioned LEI Wageningen UR to conduct a follow-up study on the impact of TESA-led FFS that have started in 2010 and a baseline study on farmers taking part in farmer-led FFS that started at the end of 2013.

In this report we present the findings of our evaluation of the TESA-led FFS with regard to farmer performance, and the baseline situation of farmers taking part in farmer-led FFS that started at the end of 2013. This baseline situation can be used in a future impact assessment to assess whether the farmer-led FFS approach is as effective as the TESA-led FFS approach.

We thank KTDA, Unilever and IDH for their trust in us to carry out this study and to provide valuable information, insights and inputs to facilitate and improve our work.

Impact assessment of FFS approaches is known to be a highly challenging endeavour both conceptually and operationally. Attribution of impact is complex because of measurement challenges, diversity of parameters and many other contributing and influencing factors. It is particularly demanding to strive for statistical rigor and practical significance under pressing constraints of time and resources. Timely and good quality data and information are essential in this process. To this end we are indebted to the hard work done by the enumerators and data entry clerks for collecting and processing of primary data. We highly appreciate the support and cooperation from KTDA factory staff and management for providing a large amount of factory data. We are grateful in particular to Mr. Peter Mbadi for his great effort in making sure we get the right data and information in time.

Our special gratitude goes to Mr. Davies Onduru from ETC-East Africa for managing the primary data collection and processing process and for assisting us with his excellent knowledge and extensive experience of the developments in the tea sector since 2006.

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Executive summary

Background and objective

The Kenya Tea Development Agency (KTDA) and Lipton Sustainable Agriculture Project introduced farmer field schools (FFS) in four pilot KTDA-managed factories in 2006. Based on the good results from the pilot phase, the partnership of KTDA, Unilever and IDH started their Sustainable Tea Program in 2009 with the aim to up-scale FFS to all 65 processing factories of the 54 KTDA tea factories. The up-scaling of FFS in this phase was mainly done through tea extension staff-led FFS **(TESA-led FFS)**.

In order to reach more farmers and buying centres of every KTDA processing plant, a new up-scaling phase has been launched in 2013 with selected FFS Graduate farmers helping in initiating and running farmer field school activities (Farmer-led FFS).
LEI Wageningen UR conducted an impact study in 2012 of the TESA-led FFS. Now that the Farmer Field Schools (FFS) programme has been up-scaled and embedded within the entire KTDA factory and management system, KTDA, Unilever and IDH wished to evaluate their Sustainable Tea Program. They have commissioned LEI Wageningen UR to conduct a follow-up study on the impact of TESA-led FFS that started in 2009 and a baseline study on farmers taking part in farmer-led FFS that started at the end of 2013.

Contribution of this report

This report presents the findings of an impact assessment of the TESA-led FFS started in 2009 and the baseline situation of farmers taking part in farmer-led FFS started at the end of 2013. This baseline situation can be used in a future impact assessment to determine whether the farmer-led FFS approach is as effective as the TESA-led FFS approach.

This report makes a unique contribution to existing impact literature with the following features:

- Multi-period impact assessment of a complex intervention like FFS with comprehensive outcome indicators, taking into account the dynamics of FFS participation over time
- Theory-based evaluation aiming at verifying the impact logic of the KTDA-Unilever-IDH Sustainable Tea Programme
- Semi-experimental design with attention to potential selection bias
- Use of primary and secondary data from different sources for data triangulation and econometric analysis

Conclusion on impact of TESA-led FFS

Between 2010 and 2014, the TESA-led FFS have had positive impacts on both immediate and intermediate outcome indicators following the impact logic of the FFS programme.

Immediate outcome indicators

- FFS have positive impacts on the further professionalisation of the KTDA farmers and their organisation in terms of improved knowledge and implementation of good agricultural practices (GAPs). Continuous participation in FFS activities has the highest impact on the knowledge of GAPs.
- FFS participants have a high level of satisfaction with FFS activities and extension services. The majority of FFS participants have benefited from participating in FFS.
- FFS participants have significantly improved their green leaf yield compared to the non-participants. The quality of their tea remains high.
- The majority of FFS participants have diversified their income sources into other income generating activities, primarily crop production and livestock production.

Intermediate outcome indicators

- FFS training and activities have led to improved decision making by farmers on the essential good practices (in line with KTDA advice) in tea production and farm management. Significantly more FFS participants have started to use what they learned from the training and recommendations by TESA/FSC/factory for their own decision-making.
- FFS participants are significantly more active in experimenting with new agricultural practices and sharing information with others, which are considered the key mechanisms through which spill-over effects materialise in the impact logic.

Despite significant improvements in the yield of green leaf and good quality of processed tea, there is still room to improve the profitability of sustainable tea by increasing production scale or by diversification of income from other sources.

Conclusion on farmer-led FFS

In the baseline situation, the basic characteristics of the farmer-led FFS participants are comparable to the non-participants except in two aspects: whether they have had training for RA certification and their household size. This suggests potential self-selection bias that should be taken into account in a future impact assessment.

Participants of farmer-led FFS have lower level of satisfaction than the participants of TESA-led FFS with factory services regarding market information on inputs, providing information about inspection results and corrective actions after internal inspections, providing access to fertiliser and pesticides and insurance.

On average, the FFS participants and the non-participants in the baseline situation do not differ significantly in key performance indicators except for the implementation of GAPs. Within an individual factory, the FFS participants can significantly differ from the non-participants in other performance indicators as well. This suggests that factory-specific factors should be taken into account in a future impact assessment.

Conclusion on unbiased participation of farmers in FFS

Overall, FFS participation itself is not biased towards a particular farm size. The situation varies, however, among different factories.

In the baseline situation of farmer-led FFS, however, it is likely that farmers who have had RA certification training or other training self-select into FFS activities. The potential self-selection bias should be addressed in a future impact assessment.

Recommendations

Based on the impact assessment and analysis of the baseline situation, we would like to recommend the following:

- Keep good records of FFS activities and participants to have better insight into the dynamics and motivations of FFS participants
- Monitor the dropout rates of participants and understand the reason for dropouts
- Organise follow-ups of FFS graduates to assess the long-term impact of FFS
- Obtain explicit information on the interaction between FFS participants and non-participants to have better insights into the materialisation of spill-over effects
- Obtain accurate information on production areas to enable better assessment of land use efficiency and productivity
- Update cost-benefit analyses of FFS activities at farm level using the latest survey data
- Address potential self-selection bias in a future impact assessment of farmer-led FFS

1. Introduction

The use of Farmer Field Schools (FFS) as an extension method is a relatively recent phenomenon within the Kenya Tea Development Agency (KTDA) in Kenya, the management agency for 560,000 smallholder tea producers. Motivated by the good results from a pilot project in 2006 with 24 FFS, it is the aim of KTDA and its partner Unilever to introduce the FFS programme to all 54 KTDA factories.

To do so, they partnered with IDH-The Sustainable Trade Initiative. The up-scaling programme started in 2010 and aims to have organised 3,200 FFS by the end of 2015, directly reaching about 96,000 farmers, 17% of all farmers connected to KTDA (Figure 1).

The FFS programme aims to professionalise farmers in such a way that they will enhance their green leaf productivity and quality and diversify their activities, resulting in higher tea profitability and increased total net income (Figure 2).

FFS are either implemented by KTDA tea extension staff (TESA-led), or by already graduated FFS farmers assisted by extension staff (Farmer-led). One FFS is implemented per buying centre, spreading the FFS programme relatively equally over the entire area where KTDA operates. In this way, the programme facilitates the transfer of knowledge and tea management practices between as many FFS participants and non-participants as possible. In this report we present the findings of our evaluation of the TESA-led FFS with regard to farmer performance, based on information from 2010, 2012 and 2014. In addition, we present the baseline situation of farmers taking part in farmer-led FFS that started at the end of 2013. This baseline situation can be used in a future impact assessment to see whether the farmer-led FFS approach is as effective as the TESA-led FFS approach.

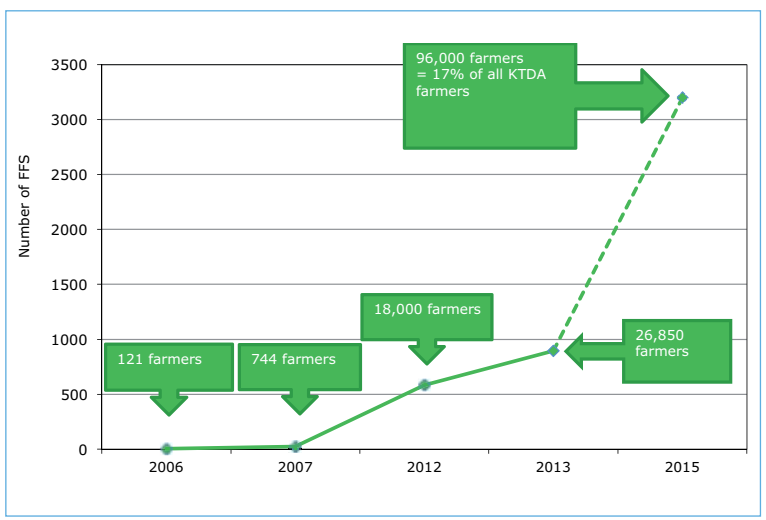

Figure 1 Actual and expected number of Farmer Field Schools and their participants between 2006 and 2015.

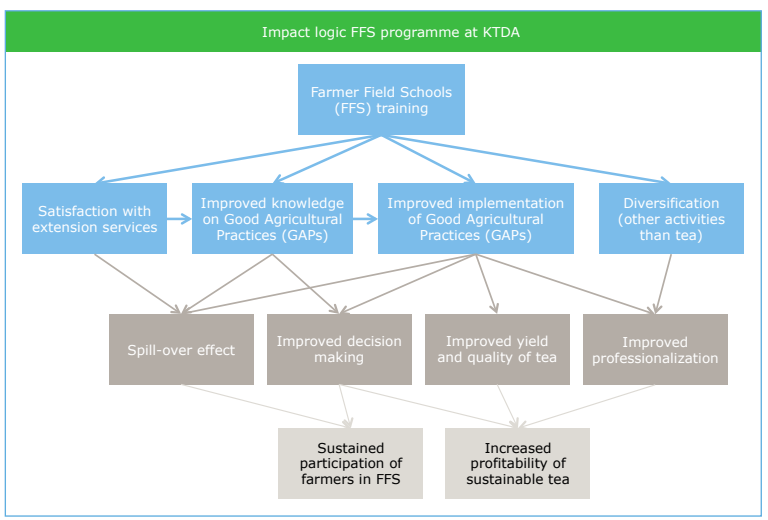

Figure 2: The impact logic of the KTDA-IDH-Unilever programme

2. Methodological approach

For the TESA-led FFS, the overall design employed in this study was a longitudinal impact evaluation using panel data that include the baseline data (2010), which measure the outcome before the intervention, and follow-up data (2012 and 2014), which measure the outcome after a passage of time deemed sufficient for the impact of the intervention to have emerged. The evaluation combines the difference-in-difference (DiD) approach, propensity score matching (PSM), and regression analysis to net out the impacts of other factors.

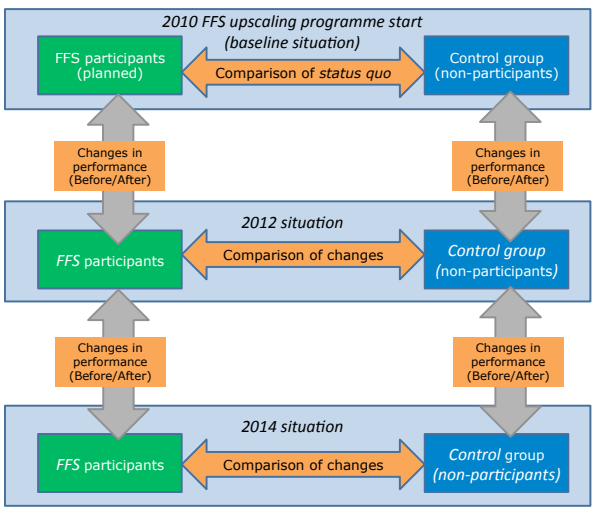

Figure 3: The difference in difference approach of assessing the impact of FFS participation

As illustrated in Figure 3, the DiD approach essentially compares the changes among the FFS participants (before and after participating in an FFS) and changes among the non-participants (the control group). The control group ideally has similar observable characteristics as those of the participants and is assumed to share a parallel trend over time with the participants, had there been no FFS. The similarity was assessed through the comparison of the status quo of the two groups in the baseline situation on a number of key characteristics and performance indicators.

Besides being influenced by variations in individual characteristics, performance indicators of tea farmers are also influenced by other external factors such as agro-ecological conditions and interventions from other organisations. The influences of these confounding factors were assessed using various regression analyses.

To establish the baseline situation of farmers participating in the farmer-led FFS and of the control farmers, we described the key characteristics and performance indicators of each group and tested for differences in the means of these characteristics and indicators. We performed propensity score matching (PSM) to assess potential self-selection bias among the FFS participants and to create a matched control group for the impact assessment in 2015 (a detailed description of the methodology can be found in Annex 1).

Sampling and data

This study has collected primary data using a household survey to interview a sample of farmers associated with 6 KTDA factories (the survey questionnaire can be found in Annex 2) and secondary data on tea production and FFS activities from KTDA. For the impact assessment, the 331 farmers who were sampled and interviewed in 2010 and 2012 [1] were interviewed again in 2014 using the same questionnaire. For the baseline situation of the farmer-led FFS, we interviewed 240 farmers from two new factories: 120 randomly selected as future FFS participants, and 120 control group farmers. Detailed information on the sample and the characteristics of the farmers can be found in Annex 3 (TESA-led FFS) and Annex 6 (farmer-led FFS).

1 See Waarts, Y., Lan Ge, Giel Ton, Don Jansen, 2012, Sustainable tea production in Kenya: Impact assessment of Rainforest Alliance and Farmer Field School training. LEI Wageningen UR, The Hague.

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Progress and dynamics of TESA-LED FFS: 2010-2014

More FFS participants and dynamics in FFS participation

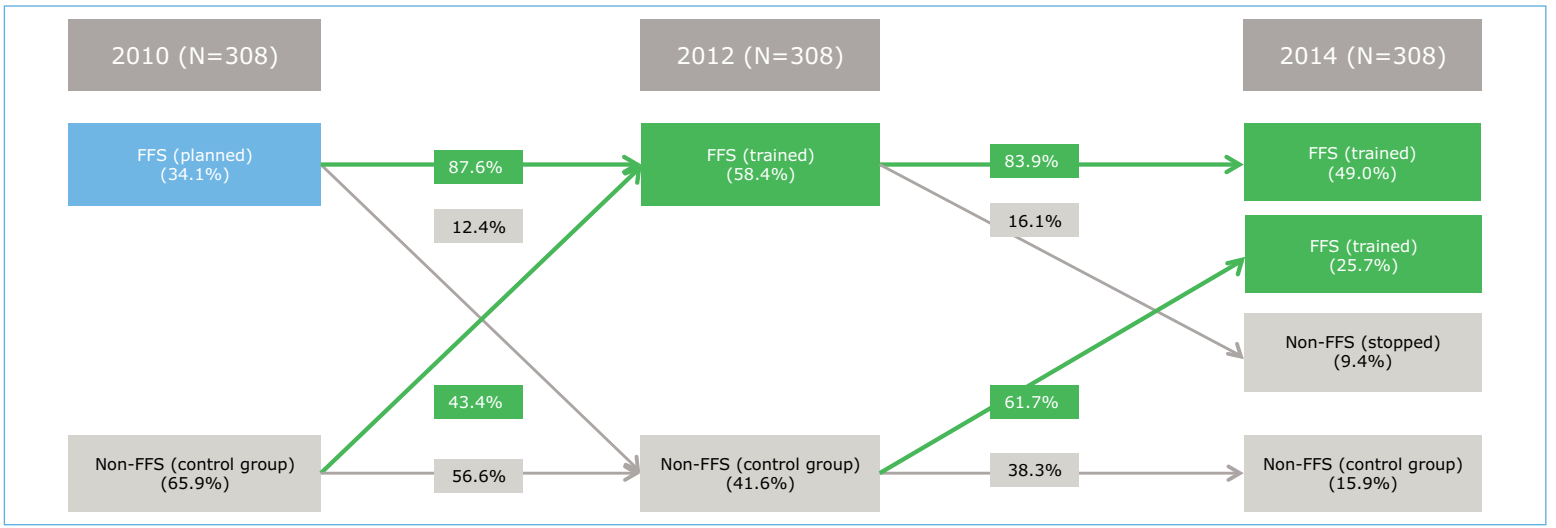

Figure 4: Changes of FFS membership among respondents

From the 331 farmers who had been interviewed both in 2010 and 2012, this study collected survey data from 308 farmers again in 2014. [1] This longitudinal data enable us to examine the dynamics in the participation and performance of these participants. Similar to the situation in 2012, the farmers' membership of a FFS can change over time as the control farmers may become member of FFS and FFS members may stop their FFS activities[2].

The survey data show that the majority of the farmers (83.9%) who had FFS training in 2012 remain as members of the FFS (Figure 4). At the sample time, about 61% of the farmers who were not trained by FFS in 2012 have become FFS member in 2014. Most farmers who remain FFS participants or become FFS participants have also been trained by Rainforest Alliance (RA).

1 The other farmers were relocated or could not participate in the survey due to various reasons.

2 As the registration list of FFS participants was not available at the time of data analysis, the information on FFS membership is based on the survey response (see question A7 in the questionnaire).

The dynamics in FFS participation means that in 2014 four groups of farmers can be distinguished among the sample farm different 'degrees of participation' in terms of duration and recentness:

- farmers who have been FFS participants throughout 2010 to 2014 (49%, 76.8% of which are also RA trained)
- farmers who have been FFS participants during the period 2012-2014 (25.7%, 79.8% of which are also RA trained)
- farmers who had been FFS participants but are not FFS participants anymore in 2014 (9.4%, 24% of which are RA trained)
- farmers who have never been FFS participants (15.9%, 30.6% of which are RA trained)

This variation in the degrees of participation makes the impact evaluation much more complex than the case when all participants have had the same degrees of participation. On the other hand, it enables us to obtain a richer picture of the short-term and long-term impact of participating in FFS and the dynamics happening in the field.

Majority of FFS participants have benefited from participating in the FFS

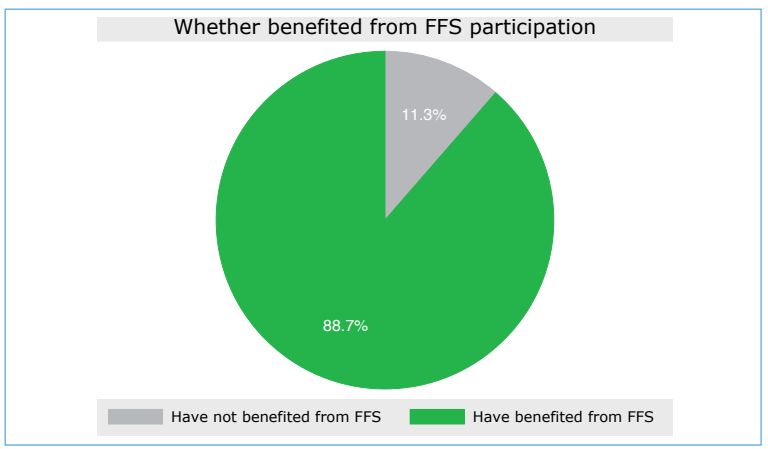

Figure 5: Whether benefited from participating in the Farmer Field School group in the last two years between 2012 and 2014 (all FFS groups)

Benefits	Percentage
Improved tea production and yield	24.4
Improved farm management	12.8
Diversification of income	11.3
Environment conservation and waste management	7.6
Better living standards, health and safety	6.1
Improved knowledge and skills	6.1
Improved income	5.8
Plucking improvement	5.5
Better handling of agro-chemicals	2.0
Improved tea management	2.0
Others	16.3

Table 1. Benefits from participating in FFS

Of the 230 farmers who are FFS members in 2014, 203 (72.5%) reported at least one benefit from their participation in FFS, resulting in total 344 benefits mentioned. The top 10 benefits reported are shown in Table 1. The 'others' category includes one to six mentions of specific skills such as pruning and weeding, the confidence to educate others, record keeping, fertiliser application, integrated pest management, savings, and communication. Diversification of income consists of a variety of activities ranging from kitchen gardening to livestock rearing.

In total 11 FFS participants in 2014 have provided 7 reasons why they have not benefited from participating in FFS group as follows:

- I never attended any FFS meeting
- I register myself only
- No follow-up
- Lack of cooperation
- No pay
- The FFS emphasised what I already knew/time wasted
- I developed a health problem
-

While reasons such as 'no follow-up' signal a need for improvement of FFS, the first two reasons actually suggest that active participation in FFS meetings is crucial in realising the expected benefits of FFS.

High levels of satisfaction with FFS activities and extension services

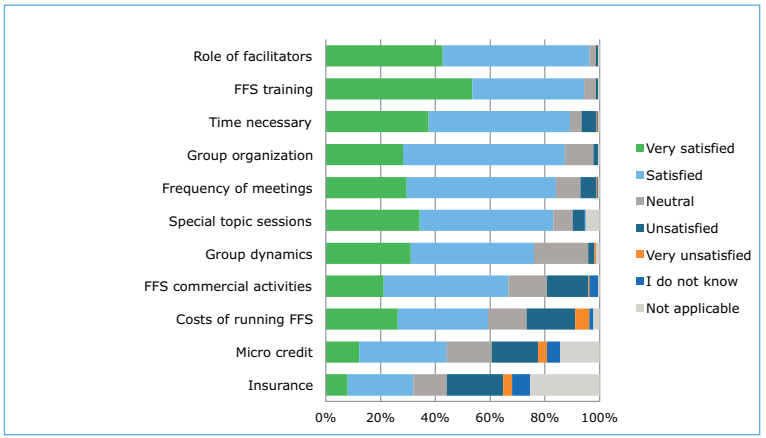

Figure 6: Satisfaction with FFS activities

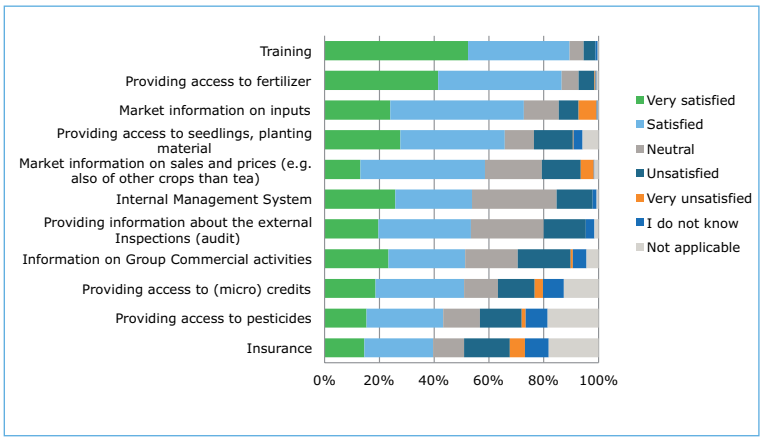

Figure 7: Satisfaction with services provided by the factory

The majority of the surveyed FFS participants are satisfied or very satisfied with most aspects of the FFS activities (Figure 6). About 20% of the FFS participants are however unsatisfied or very unsatisfied with activities related to insurance, microcredit, cost of running an FFS, and FFS commercial activities such as sales and marketing.

Apart from information provided in the training, 275 respondents (89.3%) have confirmed that the extension staff provides them with information or services that help them with tea production. The other 33 respondents (10.7%, 10 FFS participants and 23 non-participants) have indicated that the extension staff has provided no service that helps them with tea production. Figure 7 shows their evaluation of the services provided by the factory.

Both among the FFS participants and the non-participants, training and providing access to fertiliser are the two factory services with which most farmers are satisfied or very satisfied.

The percentage of FFS participants with any insurance is significantly lower than non-participants (34.8% versus 50%), both being mainly insured by Majani Insurance. More FFS participants are insured by Kinga Ya Mkulima (through KTDA) than non-participants.

FFS participants also showed a consistently higher level of overall satisfaction than the non-participants with social issues such as the relations with the tea factory, their neighbours, and family members.

Improved professionalisation in tea production

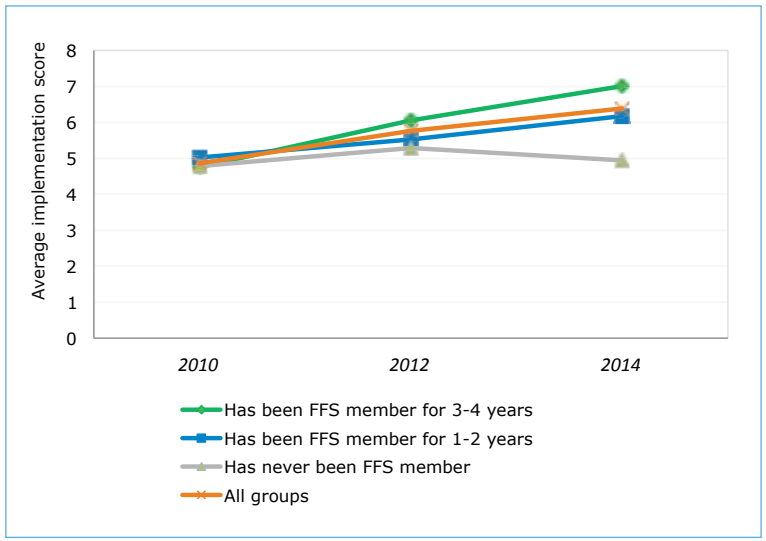

Figure 8: Changes in farmers' knowledge on GAPs over time

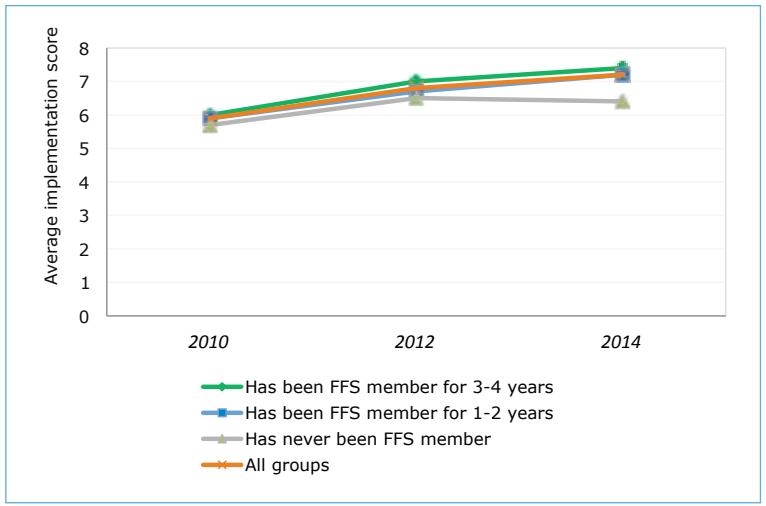

Figure 9: Changes in farmers' implementation of GAPs over time

Combining survey results from 2010, 2012 and 2014, **we observed a steady improvement of professionalisation of the FFS participants in terms of improved knowledge and implementation of good agricultural practices (GAPs)** (Figure 8 and Figure 9).

Based on respondents' answers to questions related to GAPs (see questionnaire in Annex 2), scores are calculated on a scale of one to ten according to its compliance with SAN and GAPs. The improvements are measured as significant increase in overall knowledge scores and implementation scores. The improvements are significantly higher among FFS participants than among the non-participants, showing the positive impact of FFS participation. The impact is higher among participants who have been FFS member longer (on average +0.5 per additional year of participation).

Participants with higher knowledge score have also a significantly higher implementation score, indicating that farmers have put their gained knowledge into practice. Table 2 presents the top-3 practices in each category of 'profit', 'people', and 'planet' on which the improvements of FFS participants are significantly higher than the non-participants.

Regression analysis shows that continuous participation in FFS has significantly positive impact on the increase of knowledge scores (average +0.3) and implementation scores (average +0.12).

Besides participation in FFS, the following factors have also had positive impact on or show positive correlation with the improvement in professionalisation:

- Being trained for RA certification
- Being from the east of Rift Valley
- Experimenting with new agricultural practices
- Sharing knowledge and information with others

Difference in differences in implementation scores				
	Question on sustainable practices	**Difference in Difference (FFS-Not FSS)**	**Changes between 2012 and 2014**	
		***= significant at 0.05 level**	**Non FSS**	**FFS**
Profit	At what height do you tip in?	2.30*	-1.3	1
	Do you keep records?	2.29*	-0.65	1.64
	Use plucking stick/ wand, table firm?	1.68*	-0.38	1.3
People	Do you turn to KTDA if you experience any problems in your tea production?	1.93*	-0.95	0.98
	Do your workers have access to potable water and latrines	1.10*	0.16	1.26
Planet	How do you manage household waste water and effluent from livestock?	2.27*	-0.11	2.16
	Waste is collected and taken elsewhere for recycling?	1.94*	-2.54	-0.6
	How do you mange household solid waste?	1.67*	-0.31	1.36

Table 2. Difference in differences in implementation scores

Positive changes in decision-making because of FFS training

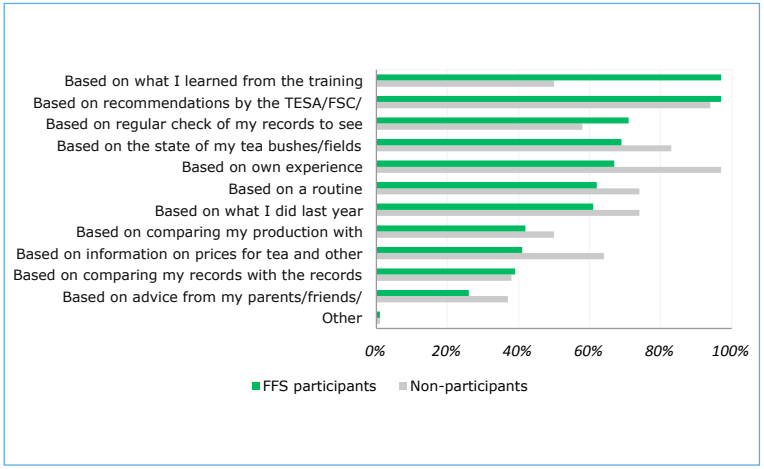

Figure 10: How farmers make decisions on tea production and management in 2014

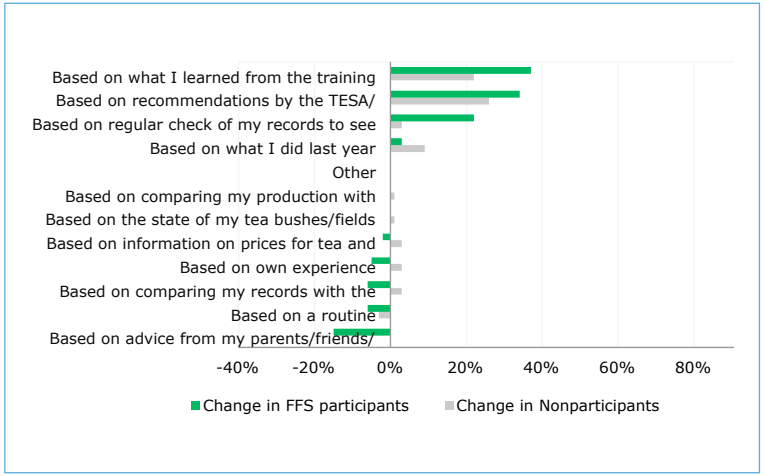

Figure 11: Changes in farmers' decision making from two years

Farmers base their decisions on tea production and management activities on a variety of factors, ranging from advice from parents, friends or neighbours to more professional sources like training and recommendations by the TESA or factory (Figure 10). **In the survey situation in 2014, significantly more FFS participants base their decision on what they learned from the training than the non-participants (96.5% versus 50%).**

Both among FFS participants and non-participants, almost half of the farmers are now making their decision based on comparing their production with figures with average tea production in Kenya or comparing their records with those of their neighbours to see how their own farms are doing.

Based on the farmers' recollection of their ways of decision-making two years ago, positive changes have taken place in their decision making towards using more professional advice and information (Figure 11). Between 2012 and 2014, significantly more FFS participants started to use what they learned from the training and recommendations by TESA/FSC/factory for their own decision-makin

Training and knowledge acquired from the training are by far the most mentioned reasons for changes in decision making. Other reasons mentioned are the following:

- to increase yield and production
- to increase income
- to adjust to weather condition
- changed due to experimentation
- changed due to information sharing

High quality of tea and positive impact on yield curve of green leaf

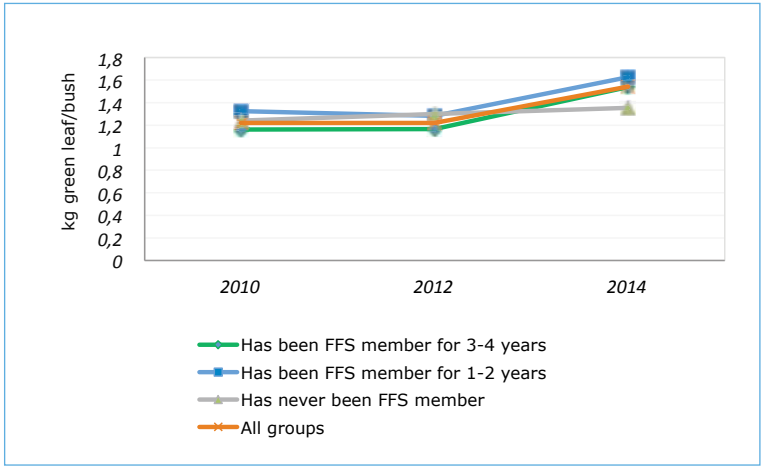

Figure 12: Change of average yield of green leaf among different FFS groups

Similar to previous years, farmers (both FFS participants and non-participants) and their factories continue producing good quality tea green leaf and processed tea. This is reflected in information from two sources:

- Factory data show that the five main grades (BP1, RPL, PF1, PD and D1) account for more than 97% of the processed tea. Of the secondary grades about 2.2% are fannings (grade F1) and 0.8% are dusts (DUST).
- Survey data show a very low rejection [1] rate of green leaf (more than 88% of the respondents never experienced rejections of green leaf by the factory). Among the farmers who had rejection, on average less than 70 kilograms of the green leaf was rejected by the buying centre, which is significant.

The average yield (kilogram green leaf per bush) of all farmers has increased from 1.22 kg/bush in 2012 to 1.54kg/bush in 2014. **Among the different groups shown in Figure 12, the increase is significantly higher among the FFS participants (about 30% compared to about 15% among the non-participants).**

Individual yields of the farmers show a high variability across region, factories and different farm sizes. This variation in individual yields is a result of complex interactions among labour and material inputs and environmental factors and may reflect different production technologies. Assessing the impact of FFS on yield must therefore take into account these influencing factors and their interactions with each other.

In assessing the net effect of FFS participation, we used linear and nonlinear regression analysis to account for the influence of the following factors on yield:

- Region (east or west of Rift Valley)
- Fertiliser use (kg/bush)
- Labour use (using total hired labour cost as a proxy, KES/bush)
- Factory

1 In practice a rejection does not mean that all products are refused but that a part of the green leaf supply is refused or part of the supply is purchased as a below standard product (hence a deduction in the kilograms lower price).

Farmers from the east of Rift Valley produce significantly more kilograms of green leaf per bush than farmers from the west of Rift Valley. As is well known in the literature, soil and weather conditions are the main contributing factors of higher yield in the east of Rift Valley. Farmers connected to factory catchments with more rainfall, i.e., Kinoro (256mm) and Litein (200mm), also had higher yields than farmers from factory catchments with less rainfall (i.e., 99mm in Ndima, 65mm in Nyankoba).

Although FFS participation consistently shows a positive impact on yield in regression analyses with different model specifications, the exact magnitude of the impact varies from 5% to 40% when other factors are taken into account (e.g. different level of labour use and farm size). However, it can be concluded that participation in FFS does improve the yield curve of green leaf production per bush. Regression analysis on yield per hectare showed similar results, but the results need to be interpreted with caution: factory data on production area are likely to be unreliable as they are converted from the number of bushes using a standard planting rate instead of being registered.

Increased diversification of income

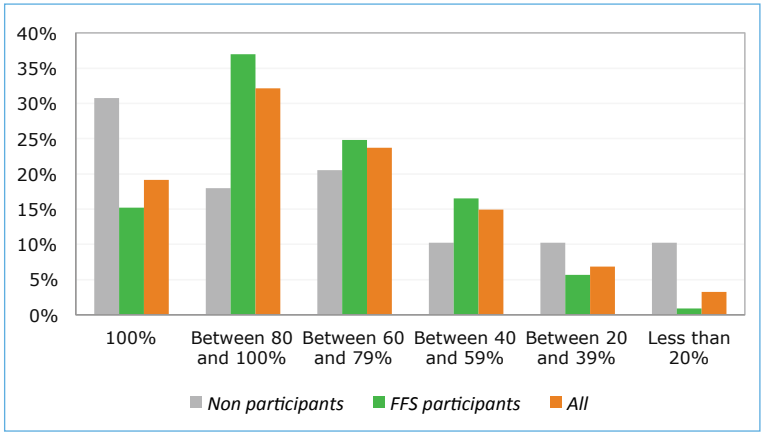

Figure 13: Percentage of income from tea production in total household income among different groups

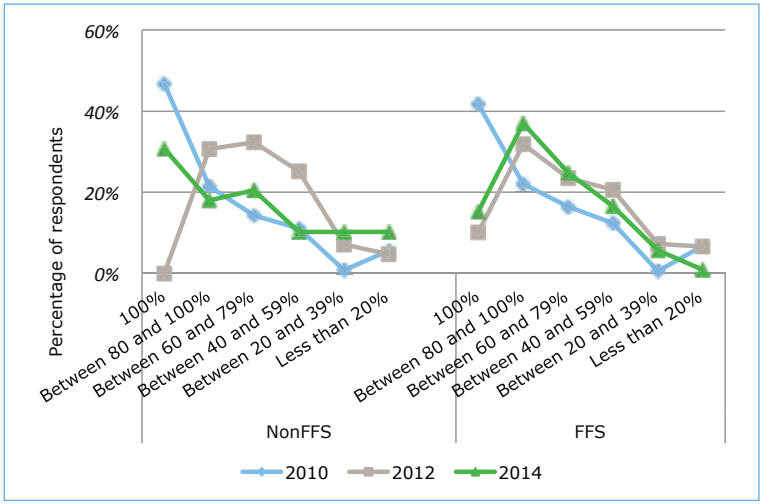

Figure 14: Changes in percentage of income from tea production in total household income over time among FFS participants during 2010-2014

In 2012 the distributions of shares of income from tea production in total household income were similar among FFS participants and non-participants. Between 2012 and 2014, there were significant changes in the percentage of income from tea production among both FFS participants and non-participants. In 2014, more non-participants had income solely from tea production or less than 20% than in 2012. This has resulted in much higher percentages of FFS members having income from other sources. The differences are however not significant. The main income generating activities are livestock production and plant production among both FFS participants and non-participants.

It should be noted that the shares of tea income in total household income are influenced by both the amount of income from other sources and the amount of tea income. A lower share of tea income therefore does not imply lower income from tea production, as it can also mean that income from other sources has increased. This possibility is corroborated by the finding **that FFS participants have reported a significantly higher income from other sources than the non-participants** (on average KES70,000/year).

Another noteworthy change is that the higher percentage of non-participants having a monthly income of more than KES20,000. This suggests that those farmers might have self-selected out of the FFS activities due to a decreased importance of income from tea production.

Spill-over effect through experiments and increased sharing of information on GAPs

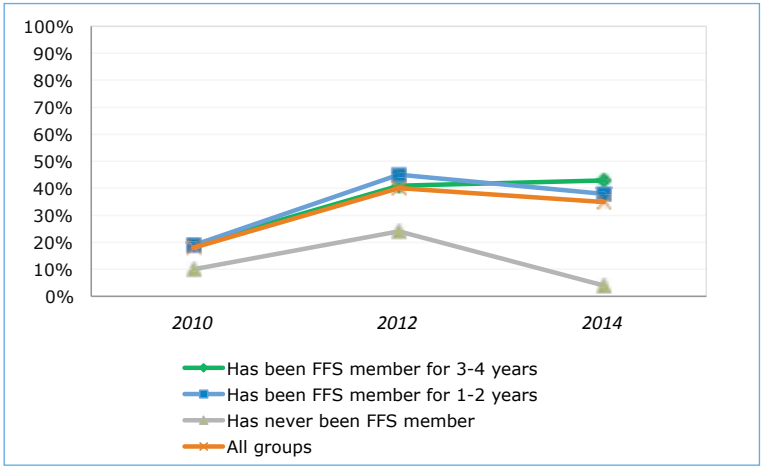

Figure 15: Percentage of farmers having experimented with new agricultural practices in the last year

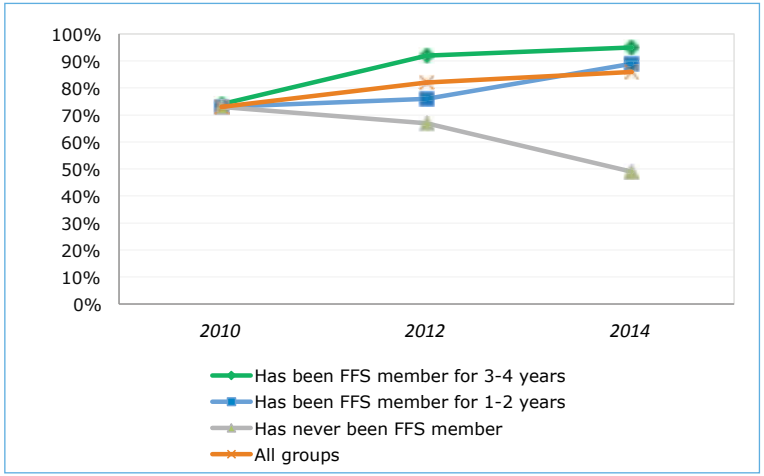

Figure 16: Percentage of farmers sharing information on GAPs with others

FFS participants are significantly more active in experimenting with new agricultural practices and sharing information than the non-participants (Figure 15 and Figure 16). Since experimentation with new agricultural practices and sharing of knowledge and information with other farmers are considered the key mechanisms by which spill-over effects are materialised in the impact logic, this outcome affirms the impact logic.

On average, farmers who have experimented or shared information with others have significantly higher knowledge scores and implementation scores on GAPs than those who do not. This could also be interpreted that farmers with a higher level of knowledge or implementation tend to experiment more and are more willing to share more information with others. On the other hand, the process of experimenting and sharing may reinforce the farmer's knowledge and implementation level and lead to the sustained improvement of sustainable practices among all farmers.

Multiple impact pathways on profitability

Key profitability parameters	Changes		DiD
	Non FFS*	FFS	
Gross margin from tea (KES/bush)	-	-	
Green leaf price+ bonus (KES)	-	-	
Yield (kg of green leaf/bush)	+	+	
Yield (kg of green leaf/ha)	+	+	
Number of bushes	-	-	
Fertiliser use (kg/bush)			
Hired labour costs (KES/bush)	+	+	-
PPE costs	-	-	
Use of hired labour (%)			
Number of other income sources	-		+

*+ and – shows significantly positive or negative changes compared to the situation in 2012

Table 3. Difference in differences of key profitabilty parameters in 2014

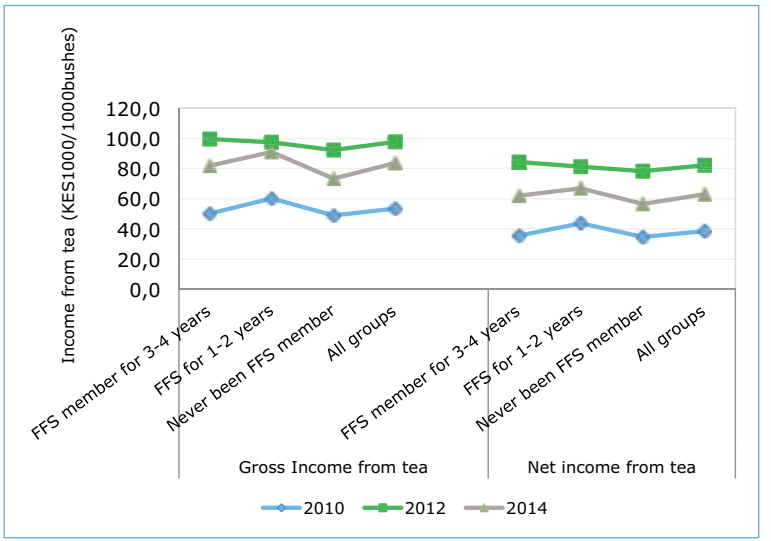

Figure 17: Changes in income from tea over time among different FFS groups

Profitability for farmers is calculated as the gross margin of tea (difference between revenue from sales of green leaf and known expenditures on tea production). We calculated the revenue based on factory records on the kilograms of green leaf bought from farmers, and the price and bonus paid to farmers by KTDA. Production costs are calculated based on the survey results.

Despite the increase in green leaf productivity, profitability of tea production has dropped on average in 2014 due to lower bonus payments. The decrease in profitability is slightly lower among FFS participants than among the control group, but the difference is not significant.

Since the difference in differences comparison does not take into account the influence of other factors, it provides only limited insight into changes in profitability. The difference in differences using regression analysis showed that after correcting for confounding factors such as agro-ecological zone and factory-specific effects, participation in FFS does have a positive effect on profitability through its interaction with labour costs.

Labour is a significant expenditure for tea farmers. Labour costs, in particular plucking costs, constitute a substantial component in the total costs of tea production. It should be noted that using family labour (i.e. family members working on the tea plantation) has an opportunity cost amounting to possible income from other income generating activities.

Baseline Situation of Farmer-led FFS (2014)

4

Medium to low level of satisfaction with extension services

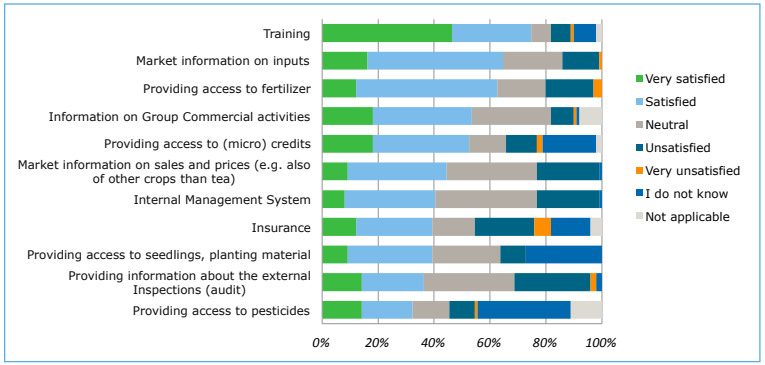

Figure 18: Satisfaction with extension services among farmers from Gachege (the east of Rift Valley)

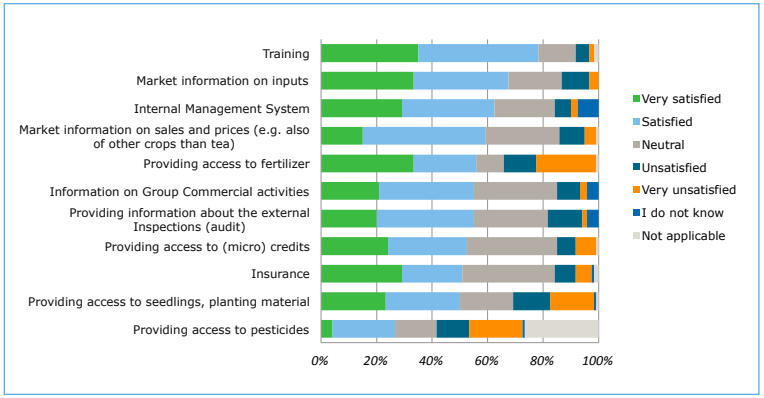

Figure 19: Satisfaction with extension services among farmers from Mudete (the west of Rift Valley)

FFS participants from the farmer-led FFS started their FFS activities at the end of 2013. For these participants, the situation as reflected by the 2014 survey is still considered as a baseline situation in which the characteristics and performance of FFS participants are expected to be comparable to the non-participants. The focus of the analysis is therefore not on the impact of FFS as in the impact assessment of TESA-led FFS, but on the comparison of the status quo of FFS participants and the control group.

In general, the percentage of farmers satisfied with various extension services is not high in the baseline (Figure 17 and Figure 18). The exceptions are the higher percentages of farmers who are satisfied with training and market information on inputs. In particular, more respondents from Gachege are satisfied or very satisfied than those from Mudete. Based on farmers' evaluation, the issues that deserve attention from both factories are the following:

- Insurance
- Providing access to seedlings, planting materials
- Providing access to pesticides

The relatively low level of satisfaction with extension services could be explained by the relatively low ratio of extension workers to farmers. On average, a KTDA factory has 4-6 extension workers to cover 10,000 farmers. This means that the amount of time an extension worker can spend with each farmer is very limited. One benefit of the IDH-KTDA-Unilever programme is therefore the fact that the programme is improving this ratio by adding the farmer-led FFS model.

There is no significant difference in the level of satisfaction with training among FFS participants from FESA-led FFS and farmer-led FFS. However, significantly more FFS participants from the TESA-led FFS than FFS participants from the farmer-led FFS are satisfied or very satisfied with factory services concerning market information on inputs, providing information about inspection results and corrective actions after internal inspections, providing access to fertiliser and pesticides and insurance.

Differences in knowledge and implementation of GAPs

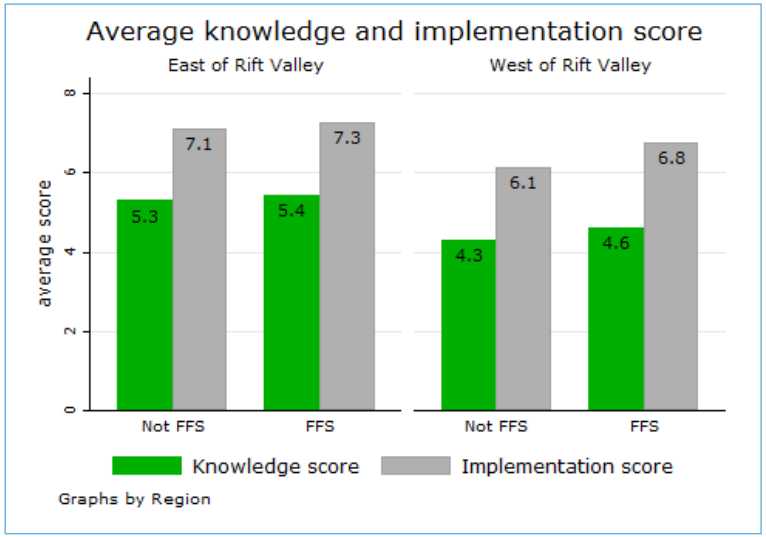

Figure 20: Average knowledge and implementation score among FFS participants and non-participants in different regions

The average level of knowledge is still low among the farmers in the baseline situation (4.9 out of 10). However, the level of implementation is already quite high (6.8 out of 10). There are significant differences between the two factories (regions) and between FFS participants and non-participants in the west of Rift Valley. These differences should be taken into account in a future impact assessment.

The knowledge scores of the participants have only weakly positive correlation with their implementation score. This suggests that farmers may have been implementing GAPs without knowing the theories behind them. A detailed list of the scores can be found in Annex A7, which can be used as inputs for the FFS curriculum.

Influence of training on decision making

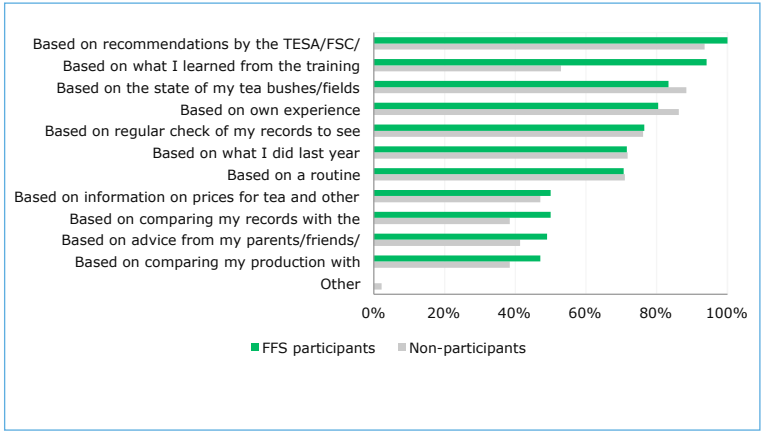

Figure 21: Ways of decision making on tea production in the baseline

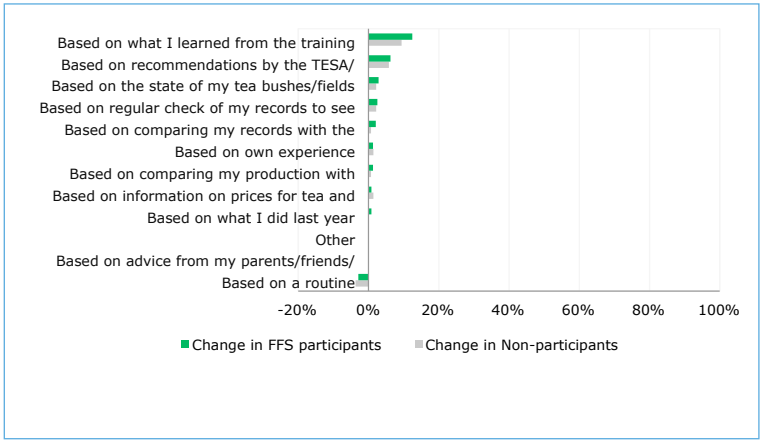

Figure 22: Ways of decision making on tea production in the baseline

In the baseline situation, significantly more FFS participants make decisions based on what they learned from training. Based on the farmers' recollection of their ways of decision-making two years ago, significantly more FFS participants have changed their way of decision making between 2012 and 2014 on tea production in general and on specific practices such as fertilisation, plucking frequency and the handling of agro-chemicals. More of them are making decisions based on what they learned from training, RA certification, and their records in 2014.

High quality of tea but still low yield of green leaf

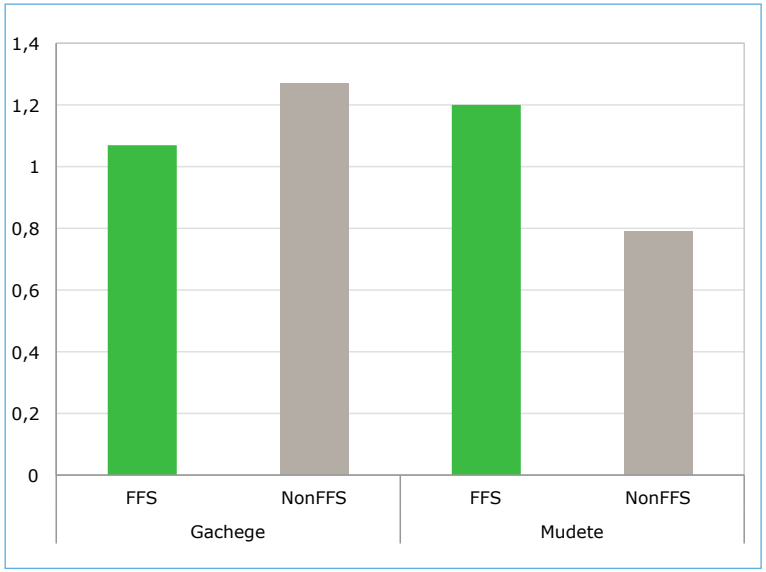

Figure 23: Yield of tea green leaf among FFS participants and non-participants from farmer-led FFS in the baseline situation

	Gachege	Mudete
BP1	12.0%	8.2%
RPL	0.4%	0.0%
PF1	62.6%	55.0%
PD	18.6%	21.3%
D1	4.6%	11.5%
F1	1.8%	3.3%
DUST	0.0%	0.7%
TMF	0.0%	0.0%
Total % main grade	98.2%	96.0%

Table 4. Grade of processed tea at the factories in 2012/2013

In the baseline situation, farmers from both factories have on average a relatively low yield of green leaf per bush. The FFS participants in Mudete, however, have a significantly higher yield than non-participants. This correlates positively with their implementation score, implying the positive effect of GAPs on green leaf yields.

Even though FFS participants have higher green leaf yields than non-participants, and Kenyan smallholders' yields are much higher than the yields of smallholders in other African countries such as Malawi, Rwanda, Tanzania and Uganda, there is still a yield gap, as yields up to 2 or 3 kg/bush could be reached (e.g., the Kericho plantation of Unilever reaches up to 2 or 3 kg per bush).

Farmers from all groups and factories produce good quality tea. This is based on two sources of information:

- Household survey information: a low rejection rate (85% never had rejection, 12% less than 3 times)
- A high percentage of main grade tea produced by the factories (Table 4)

Room to improve profitability of tea production

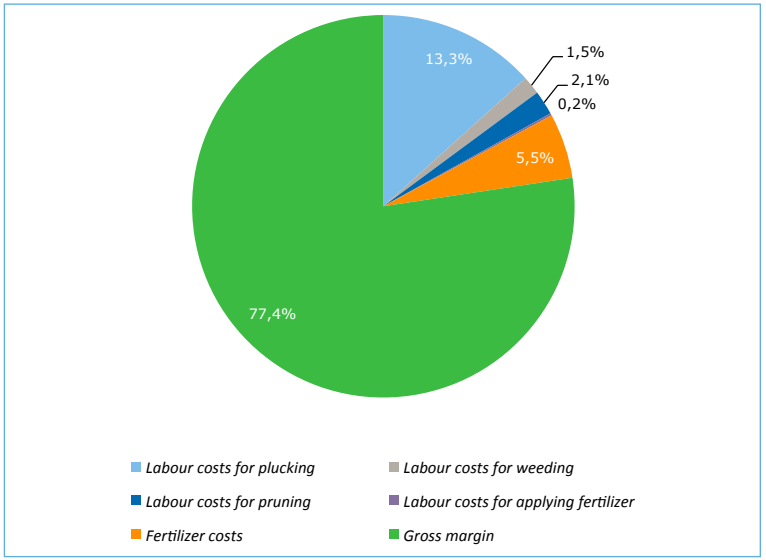

Figure 24: Costs of tea production and gross margin with average farm size of 2000 tea bushes

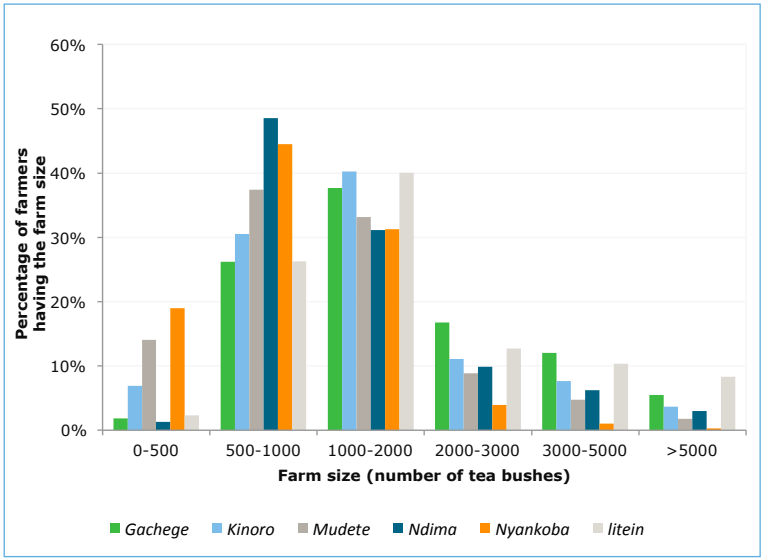

Figure 25: Distribution of farm sizes in different factories

Based on information on input use and costs from the household survey, the costs and gross margin of tea production for farmers with 2000 tea bushes are estimated and illustrated in Figure 24 (see the basic revenue-cost model in Annex 7). The average number of bushes per farmer of 2000 bushes is taken as farm size for the analysis.

With a sales price of 45 KES/kg of green leaf, the gross margin for 2000 bushes with a yield of 1.3 kg/bush is about KES117,000 (about USD1,065). For an average farm household with 4 people, this would mean an income lower than USD1 per capita per day if the household has no other income sources.

Based on the distribution of farm sizes among farmers of the 6 factories (Figure 25, compiled based on KTDA factory data), more than 80% of the tea growers have 500-3,000 tea bushes. This means that tea income for most households would be even lower than USD2 per day. This situation creates a necessity to increase tea production or generate income from other sources.

Diversification of income

Both among FFS participants and non-participants, the majority of the households have other sources of income than tea. The main sources are primarily agriculture (crop production and livestock farming). The distribution of the shares of income from tea seems to differ between the FFS participants and the non-participants, as a higher percentage of non-participants relies solely on tea production or relies primarily on other income sources than the FFS participants. However, the differences are not statistically significant. As observed in the evaluation of the TESA-led FFS, the percentages can vary over time.

Both among FFS participants and non-participants, about 50% of the respondents agreed with the statement that their income from tea production has increased and about 40% agree that their income from other sources increased between 2012 and 2014.

About 29% of the farmers have loans or micro credit in 2014. There is no significant difference among the two groups. With regard to the use of income from their tea farms, significantly more FFS participants have bought mobile phones (33%) than the non-participants (17%) in 2014.

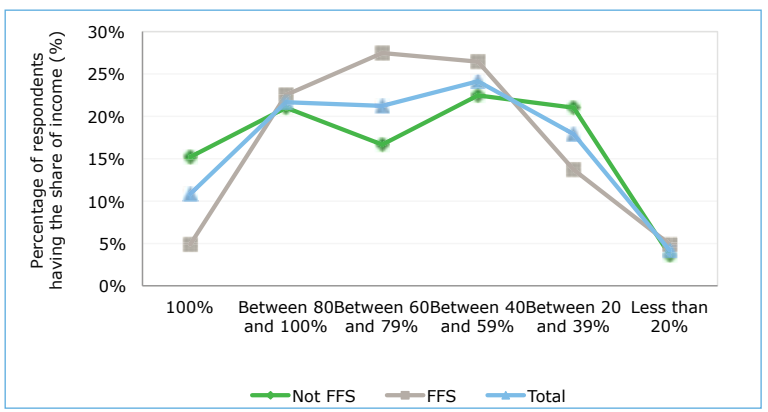

Figure 26: Percentages of farmers having different shares of income from tea in total household income

Comparison of performance

Except for the implementation score, the FFS participants and the non-participants on average do not differ significantly in the baseline in key performance indicators.

Assuming that farmers' decisions to participate in FFS are influenced by their characteristics like age, gender, education level, farm size, training background and their region, we applied PSM to match FFS participants with the control farmers in terms of their estimated propensity score. Of the 240 farmers, 238 are matched. This matching can be used in a future impact assessment to estimate the net treatment effect of FFS activities.

Key outcome indicators	FFS	Non-FFS	Difference
Knowledge score	4.96	4.85	+0.11
Implementation score	6.96	6.38	+0.58*
Yield (kg/bush)	1.18	1.03	+0.15
Fertiliser use (kg/bush)	0.083	0.085	-0.002
Income from other sources (KES/month)	5,460	3,777	+1,682
Satisfaction with social indicators	0.920	0.828	+0.08

*=significant at 5% level

Table 5. Comparison of key performance indicators

Unbiased participation of farmers in FFS

5

Potential self-selection into farmer-led FFS activities

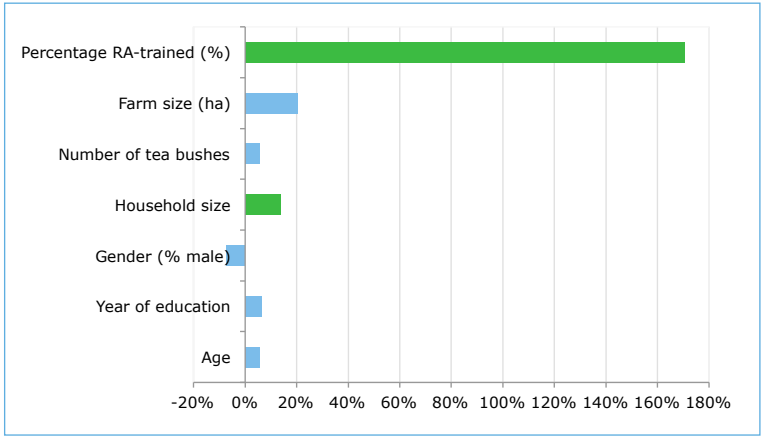

Figure 27: Comparison of key characteristics of FFS participants and non-participants (green bars indicate significant difference)

In the baseline situation, significantly more farmers registered as FFS members have had RA-training than the non-participants. This may result in a self-selection bias for a future impact assessment.

In impact assessment, two types of selection bias can lead to a wrong estimation of project impact: placement bias and self-selection bias. The first refers to the fact that the project placement is not random. For example NGOs and other extension services may operate in areas with better market access. This can result in overestimation of impact due to the favourable market conditions that may lead to higher profitability. The self-selection bias can arise when programme participants choose to participate or not based on their own expectations, objectives, and observable and unobservable characteristics that affect participation.

Since participation in the FFS programme is voluntary, self-selection can easily occur, which makes it important to determine whether differences in participants have affected the differences in outcome between the two groups.

As shown in Figure 27, on average, FFS participants and non-participants in the baseline situation are comparable except in two aspects: whether they have had training for RA certification and their household size. Differences in both aspects are, however, mainly caused by the differences among farmers from the factory Mudete (in the west of Rift Valley) where about 92% of the FFS participants have had RA-training, compared to only 20% of the non-participants. In the east of Rift Valley (Gachege), the percentages of RA-trained farmers among non-participants and participants are 32% and 45% respectively. The difference is not significant. However, significantly more FFS participants from Gachege have had other certification scheme training (UTZ Certified, ISO) or non-certification training than the non-participants (56% vs. 32%). This suggests a potential self-selection bias, meaning that farmers who have had more training are more willing or ready to participant in FFS than those who have had less or no training.

Although self-selection bias presents a methodological challenge to assessing the net impact of FFS activities in a future impact assessment, identifying the determinants of self-selection may help improve the up-scaling of FFS activities to benefit more smallholder farmers. This requires additional data and information on the observable characteristic of both FFS participants and non-participants to obtain better insight into the motivation of FFS participation. To this end, it is recommended to keep good records of key characteristics of FFS participants such as gender, age, level of education, and farm size that are known to influence farmers' participation in FFS activities.

Unbiased participation of FFS participants

	Factory	FFS participants		All farmers		Factory	FFS participants		All farmers	
Farm characteristics		Mean	Sd	Mean	Sd		Mean	Sd	Mean	Sd
TESA-led FFS	Kinoro					Litein				
Production area (ha)[1]		0.18	0.14	0.20	0.64		**0.81**	0.77	0.25	0.44
Number of tea bushes		1,575	1,180	1,792	5,637		3,126	2,757	2,292	3,930
Tea production (kg of green leaf)		2,411	2,021	1,541	3,901		4,353	6,024	1,781	3,779
Average yield (kg of green leaf/bush)*		**1.53**	0.17(se)	0.86			**1.22**	0.20(se)	0.78	
	Ndima					Nyankoba				
Production area (ha)		0.17	0.11	0.16	0.19		0.33	0.21	0.58	0.43
Number of tea bushes		1,496	1,005	1,403	1,654		1,079	588	966	709
Tea production (kg of green leaf)		2,988	1,840	2,237	2,652		1,222	1,027	1,022	1,062
Average yield (kg of green leaf/bush)		**2.00**	0.14(se)	1.60			1.38	0.18(se)	1.07	
Farmer-led FFS (new)	Gachege					Mudete				
Production area (ha)		0.84	0.52	0.23	0.24		0.78	0.60	0.31	0.38
Number of tea bushes		1,551	749	2,022	2,042		1,541	1,250	1,337	1,661
Tea production (kg of green leaf)		1,657	727	3,743	3,760		1,867	2,901	1,141	1,903
Average yield (kg of green leaf/bush)		**1.07**	0.08	1.85			**1.20**	0.16(se)	0.85	
	All three factories					**All three factories**				
Production area (ha)		0.36	0.42	0.19	0.43		0.74	0.68	0.39	0.44
Number of tea bushes		1,534	991	1,679	3,749		2,306	2,296	1,498	2,486
Tea production (kg of green leaf)		2,454	1,747	2,296	3,508		3,070	4,856	1,293	2,465
Average yield (kg of green leaf/bush)		1.51	0.07(se)	1.36			1.33	0.13(se)	0.87	

*average yield calculated as total green leaf divided by total number of bushes of the group; Sd = standard deviation; se=standard error. Mean values in bold indicate significant difference between FFS-participants and all farmers.

Table 6. Comparison of FFS farmers and all farmers from the factory

After being a member of FFS for at least 2 years, the profiles of FFS participants from previous phases of up-scaling do not differ significantly from the average farmer from the same factory in terms of farm size and production area. However, they have in general much higher yields than the average yield of the whole factory. Farm sizes (number of bushes) of FFS participants from the two new factories differ significantly from the average of the factories, but in different ways. This suggests that FFS participation itself is not biased towards particular farm size.

1 Except for the area figures from Gachege and Mudete, the figures of production area are likely to be inaccurate as they are calculated using standard planting rates instead of actually measured.

6. Conclusions and recommendations

Conclusion on impact of TESA-led FFS

Between 2010 and 2014, the TESA-led FFS have had positive impacts on both immediate and intermediate outcome indicators following the impact logic of the FFS programme.

Immediate outcome indicators

- FFS have positive impacts on the further professionalisation of the KTDA farmers and their organisation in terms of improved knowledge and implementation of good agricultural practices (GAPs). Continuous participation in FFS activities has the highest impact on knowledge of GAPs.
- FFS participants showed a high level of satisfaction with FFS activities and extension services. The majority of FFS participants have benefited from participating in FFS.
- FFS participants have more significantly improved their green leaf yield than the non-participants (on average 0.20kg/bush). The quality of tea remains good.
- The majority of FFS participants have diversified their income sources into other income generating activities, primarily plant production and livestock production.

Intermediate outcome indicators

- FFS training and activities have led to improved decision making by farmers on the essential good practices (in line with KTDA advice) in tea production and farm management. Significantly more FFS participants have started to use what they have learned from the training and recommendations by TESA/FSC/factory for their own decision-making.
- FFS participants are significantly more active in experimenting with new agricultural practices and sharing information with others, which are considered the key mechanisms by which spill-over effects are materialised in the impact logic.

Despite significant improvements in the yield of green leaf and the good quality of processed tea, there is still room to improve the profitability of sustainable tea by increasing production scale or by diversification of income from other sources.

Conclusion on farmer-led FFS

In the baseline situation, the basic characteristics of the farmer-led FFS participants are comparable to the non-participants except for in two aspects: whether they have had training for RA certification and their household size. This suggests potential self-selection bias that should be taken into account in a future impact assessment.

Participants of farmer-led FFS have a lower level of satisfaction than the participants of TESA-led FFS with factory services regarding market information on inputs, providing information about inspection results and corrective actions after internal inspections, providing access to fertiliser and pesticides and insurance.

On average, the FFS participants and the non-participants in the baseline situation do not differ significantly on key performance indicators except for on the implementation of GAPs. However, the comparison differs between the two factories sampled.

Conclusion on unbiased participation of farmers in FFS

Overall, FFS participation itself is not biased towards a particular farm size. The average farm size of FFS participants can however significantly differ from that of the non-participants among some factories.In the baseline situation of farmer-led FFS, however, it is likely that farmers who have had RA certification training or other training self-select into FFS activities. The potential self-selection bias should be addressed in a future impact assessment.

Recommendations

Based on the impact assessment and analysis of the baseline situation, we would like to recommend the following:

- Keep good records of FFS activities and participants, to have better insight into the dynamics and motivations of FFS participants
- Monitor the dropout rates of participants and understand the reason for dropouts
- Organise follow-up of FFS graduates to assess the long-term impact of FFS
- Obtain explicit information on the interaction between FFS participants and non-participants to have better insights into the materialisation of spill-over effects
- Obtain accurate information on production area to enable better assessment of land use efficiency and productivity
- Update cost-benefit analysis of FFS activities at farm level using the latest survey data
- Address potential self-selection bias in a future impact assessment of farmer-led FFS

7. Literature/websites

Literature

1 Davis et al. (2010) Impact of Farmer Field Schools on Agricultural Productivity and Poverty in East Africa. IFPRI Discussion paper 00992.

2 IDH-the sustainable trade initiative (2013). Cost-Benefit Analysis of Farmer Field School and Certification for Smallholder Tea Farmers in Kenya: An IDH learning study executed in close collaboration with KTDA, Unilever and Rainforest Alliance.

3 Knopp, D., J. Foster, 2012. Tea sector analysis: The economics of sustainability. Wood Family Trust and GATSBY. www.idhsustainabletrade.com/site/getfile.php?id=331

4 Koskei, R.C., J.K. Langat, E.C. Koskei, M.A. Oyugi, 2013. Determinants of Agricultural Information: Access by Small Holder Tea Farmers in Bureti District, Kenya. Asian Journal of Agricultural Sciences 5(5): 102-107, 2013

5 Owuor, P.O. et al. (2010) Country Report: Sustainability of Smallholder Tea Growing in Kenya. http://www.teascience.org/pdf/chapter-16-1-sustainability.pdf

6 Rosenbaum, P.R., and D.B. Rubin (1983). The central role of the propensity score in observational studies for causal effects. Biometrika 70 (1): 41-55

7 Waarts, Y., L. Ge, G. Ton, 2013. From training to practice. Midterm evaluation of the UTZ-Solidaridad smallholder tea programme in Malawi. LEI Wageningen UR, The Hague. Commissioned by UTZ Certified and Solidaridad. LEI report 2013-051, LEI Wageningen UR, the Hague, the Netherlands

Websites

1 KTDA: http://www.ktdateas.com/

2 The tea board of Kenya: http://www.teaboard.or.ke

Annexes

The Annexes to this report can be accessed by following this link: http://edepot.wur.nl/305592